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# WATER QUANTITY AND QUALITY SURVEY NAUGHTON — WATERS TOWN OF WALDEN

JANUARY 1977

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# WATER QUANTITY AND QUALITY SURVEY

## NAUGHTON - WATERS

## TOWN OF WALDEN

JANUARY 1977

Prepared by: Municipal & Private Abatement Section,
Sudbury District,
Ministry of the Environment.

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# INTRODUCTION

At the Walden Sewage and Water Technical Committee* meeting on September 16, 1976 it was agreed that Ministry of the Environment staff would conduct a water quantity and quality survey in the area of the Town of Walden being considered for Provincial Projects for water and sewer services. This survey would be undertaken in order to establish the urgency for the projects and to provide adequate information for an Environmental Assessment Board public hearing. Previous investigations carried out in 1969 and 1972 were limited in extent, and environmental and health problems had not been adequately identified.

* A committee established to co-ordinate the provision of water and sewer services in Walden and composed of representatives from the Town of Walden as well as technical staff of the Regional Municipality of Sudbury and the Ministry of the Environment.

## SURVEY PROCEDURES

As the residential developments to be surveyed were naturally separated due to geographical features, it was decided to investigate each separately. It was anticipated that in this manner the areas with the greater health and environmental problems would be identified. For the purposes of the survey, the residential developments were divided into the following sub-areas; Oja, Naughton, Rauhala, Pentney, Mountainview, Old Soo Road, Black Lake Road and Mikkola (See map Appendix A).

The field work was completed in the period from September 29 to October 18, 1976. It is estimated that the 251 homes visited constituted 25 to 30 percent of the homes in the district. The number of homes visited in each sub-area was as follows:

Oja - 13
Naughton - 79
Rauhala - 24
Pentney - 15
Mountainview - 9
Old Soo Road - 13
Black Lake Road - 31
Mikkola - 67

The field work for the survey consisted of the collection of samples from 251 wells for bacteriological examination and chemical analysis, the collection of 11 surface water samples for bacteriological examination, and the completion of 249 questionnaires (see Appendix B) with the assistance of the householders. The lots were inspected for any obvious sewage system malfunction, and a sketch was drawn showing the location of the well and the sewage system with respect to the dwelling.

The samples collected for bacteriological examination were taken to the Ministry of Health laboratory in Sudbury and the samples for chemical analysis were sent to the Ministry of the Environment laboratory in Toronto.

The parameters analysed from the chemical samples included hardness, alkalinity, iron, chloride, pH, nitrite, nitrate, colour, turbidity, and conductivity.

## SEWAGE DISPOSAL

Tabulation of the information derived from the questionnaires indicated that all the households had septic tanks and leaching beds for sewage disposal, with only a few residents reporting any problems in the operation of the systems. The sewage systems had been installed over a period of 30 years with the majority of systems having been installed nearly 15 years ago. With the exception of the Naughton area, where there were a few smaller lots, it was found that the size of the lots were 15,000 square feet or greater.

During the inspection of the lots, only one obviously faulty sewage system was detected. This was reported to the Sudbury and District Health Unit for corrective action. It was also found that a number of sewage systems installed more than 10 years ago were constructed closer to wells and surface water bodies than permitted by present regulations. It is highly probably that these older systems would also have a smaller septic tank volume and area of leaching bed than required by present regulations. Surficial soils in the area varied from well-drained sand in Naughton to the clays noted in the Mikkola development.

As undersized and improperly maintained sub-surface sewage disposal systems can cause bacteriological contamination of surface waters, the degree of contamination of nearby ditches and streams is usually indicative of the performance of these systems.

A total of 11 surface water samples were collected for bacteriological examination from ditches and creeks in the area. The results and sampling location points are outlined in Appendix C Table 4. While these results indicate there may be impairment of the surface waters sampled in the Black Lake Road and Old Soo Road areas, it must be noted that the results provided are for a single sample rather than being a series of at least ten samples per month as prescribed for bacteriological sampling of surface water. Ministry of the Environment standards for total body contact recreational use of surface waters recommend that microbiological criteria not exceed 1000 total coliforms per 100 ml and 100 fecal coliforms per 100 ml.

As the Sudbury and District Health Unit have the responsibility for approval and investigation of complaints of sub-surface sewage disposal systems, they were contacted in an effort to determine the extent of sewage disposal problems in the area. It was learned that there have not been a large number of sewage disposal problems and that the majority of problems are associated with the sewage systems installed over 10 years ago.

Malfunctioning sewage systems in the area were attributed to inadequate septic tank size and the length of tile fields for the older systems. The high groundwater table was felt to be responsible for some problems in the Mountainview and the Old Soo Road areas. No problems with ponding sewage were noted in the Naughton area although seepage from sewage systems to a creek was detected. It was the opinion of the Health Unit staff that if a water system only were installed, problems of overloaded sewage systems would be realized in the high density areas.

## WATER QUANTITY

The assessment of the quantity of groundwater available was made mainly on the information supplied by the householders. The information derived from the questionnaires for the different areas was tabulated and is presented in Appendix C, Table 1. Indicated is the number and percentage of each type of well used and the number and percentage of householders who felt that their water supply was sufficient or insufficient. With the exception of the Mikkola, Black Lake Road, and Old Soo Road areas, it was found that dug wells were the most common type of source used. Mikkola and Oja were the only areas where drilled wells were prevalent. Overall, 51% of the householders used dug wells, 30% used point wells, 18% used drilled wells, and 2% utilized springs or hauled water for household needs. It was found that the wells were installed over the past 30 years with the average well having been installed approximately 12 years ago.

A total of 74 residents or 30% of the number interviewed said that they suffered from an insufficient water supply, either on a full time basis or at certain times of the year. The Naughton and Mikkola areas, which are the largest by population, had the highest percentage (38 and 36% respectively) of residents who said they had insufficient supplies. The Pentney area had the lowest percentage (7%) of residents who claimed that their water supply was insufficient. There did not appear to be a relationship between the type of well used and the quantity of water available.

From an Ontario Water Resources Commission Groundwater Report completed in 1970, it was learned that underlying Precambrian Shield bedrock was heavily scoured by the last glacier, resulting in depressions of up to 250 feet. These depressions became filled to varying degrees by drift materials such as gravels, sands, and silts between the bedrock outcroppings noted throughout the area. This type of relief differentiation caused entirely separate hydrogeological systems, which in part explains the widely divergent water supplies noted. The bedrock material is very water-poor or impermeable, although fractures may contain sufficient water for domestic yields.

Fine-grained materials such as clays, silts and sands are the major overlying soil types in the area. These fine-grained materials do not have good water yielding properties and they also largely restrict precipitation recharge of the underlying aquifer by allowing runoff of rainwater. Although in some areas there are deep-lying deposits of promising water-bearing formations such as coarse sand and/or gravel, the recharge necessary to sustain good yields may not be sufficient. Another problem associated with poor recharge is the limited aerial extent of the dish-like depressions on which to collect rainwater in sufficient quantities for productive dug wells.

## WATER QUALITY

The residents opinion of the quality of the water was determined by tabulating the comments from the questionnaire. As expected, the most common complaint was about the hardness of the water, followed by iron staining of laundry and plumbing fixtures. A total of 10 taste, 17 odour, 18 colour, 47 iron, and 76 hardness complaints were noted. The Rauhala area had the highest incidence of the taste problems (16% of the total). Odours, which were noted mainly in the Spring and Fall during high water level periods, were most noticeable in the Old Soo Road area (15% of the total). Colour complaints were lower than expected for groundwater supplies but were mentioned more in the Pentney and Mountainview areas (20% of the total). Iron and hardness were ususally mentioned together by the residents as being noticeable with the higher percentage also being found in the Pentney and Mountainview areas.

Of the 251 well water supplies sampled for bacteriological examination, 53 supplies or 21% were found to have either fecal or total coliform bacteria or both. Only 9 of the 53 adverse bacteriological samples were found to contain fecal coliform. The number and percentage of supplies having bacteriological contamination for each of the areas surveyed is tabulated in Appendix C Table 2. The percentage of well supplies found to contain bacteriological contamination ranged from 3% of the supplies in the Mikkola area to 46% in the Old Soo Road area and 48% in the Black Lake Road area. The difference in the surficial soils and the age of the sewage system would appear to be the cause of the higher incidence of contamination in the latter two areas.

The fecal coliform organisms are found in the intestinal tracts of warm blooded mammals. Their presence indicates that the wastes of warm blooded animals including man are entering the water table on a localized basis. Total coliform organisms are also found in the intestines of warm blooded animals but some may be found in soil. The presence of total coliform is thought to indicate less recent pollution via runoff or infiltration due to their ability to live longer than the fecal group.

Of the 251 well water supplies sampled for chemical analysis, 21 supplies or 8.4% were found to exceed Ministry of the Environment criteria of 10 mg/l for nitrate, 68 supplies or 27% were found to exceed the criteria of 0.3 mg/l for iron, 88 supplies or 35% exceeded the criteria of 5 Hazen units for colour, and 112 supplies or 45% exceeded the criteria of 1 Formazin turbidity unit for turbidity. The number and percentage of supplies having excessive nitrate, iron, colour and turbidity for each of the areas surveyed is tabulated in Appendix C Table 2.

Although nitrates were not detected in the groundwater supplies in four of the areas surveyed, they were excessive in 13% of the samples in Naughton and 33% of the samples in the Pentney area. The range and mean for nitrate and iron are tabulated in Appendix C Table 3. The mean value of 6.9 mg/l and 3.4 mg/l for nitrates in the Pentney and Naughton areas indicates that the groundwater is being contaminated by sewage effluent from sub-surface sewage systems. Higher nitrate contamination appears to occur in the well-drained sandy or granular soils rather than in the areas with poorly drained clays and silts.

Iron ranged from less than 0.01 to 4.9 mg/l in the water supplies sampled. From the 13 samples examined for iron in the Oja area it was found that the mean iron value was 0.67 mg/l. Iron above 0.3 mg/l is objectionable as it imparts a brownish colour to fixtures and laundry and causes a bitter taste. It is non-toxic at higher levels and the criteria of 0.3 mg/l is set for aesthetic reasons rather than health considerations.

Drinking water that exceeds 5 Hazen units is aesthetically displeasing. Most naturally coloured water supplies are harmless. In groundwater supplies, colour is usually associated with iron and/or manganese. It was found that colour exceeded 5 Hazen units in 35% of the supplies sampled.

Turbidity units greater than 1 Formazin unit impair water clarity. Turbidity like colour, is an aesthetic problem and does not by itself constitute a health problem. It was found that turbidity exceeded the criteria of 1 unit in 45% of the well supplies sampled.

The other parameters analysed for chemical examination did not constitute widespread or significant problems.

Householders whose water supply contained any coliform organisms or had nitrate values exceeding 10 mg/l were immediately advised of the potential hazard by letter.

## CONCLUSIONS

From the results of the samples collected for bacteriological and chemical examination it is evident that the groundwater in the study area is of poor quality due to the significant number of samples that exhibited bacteriological contamination and excessive levels of nitrates, iron, colour and turbidity. The amount of groundwater is also limited as indicated by the 30% of the residents who stated they had insufficient supplies.

While the sub-surface sewage disposal systems appeared to be operating satisfactorily in most of the areas, it was found that they were causing some deterioration of the quality of the groundwater. This was most evident by the elevated levels of nitrates found in the Pentney and Naughton areas and the high percentage of wells found with bacteriological contamination in the Black Lake Road and the Old Soo Road areas. While the results of the surface samples collected for bacteriological examination appear to indicate that some of the sewage systems in the Old Soo Road and Black Lake Road areas are malfunctioning it is possible that these systems could be located and repaired or upgraded individually.

From the findings of the study the need for both communal water and sewage works has been substantiated. It would appear that more environmental and health problems will be eliminated by assigning a greater priority to the installation of a communal water system. Installation of communal sewage works would prevent further contamination of the groundwater.

The installation of a communal water system could be expected to increase the water consumption by the residents and thus put more "strain" on the ability of the soil to absorb and treat the effluent from the septic tanks. This negative aspect would be more pronounced in the Mikkola area due to the magnitude of the development and the clay soils.

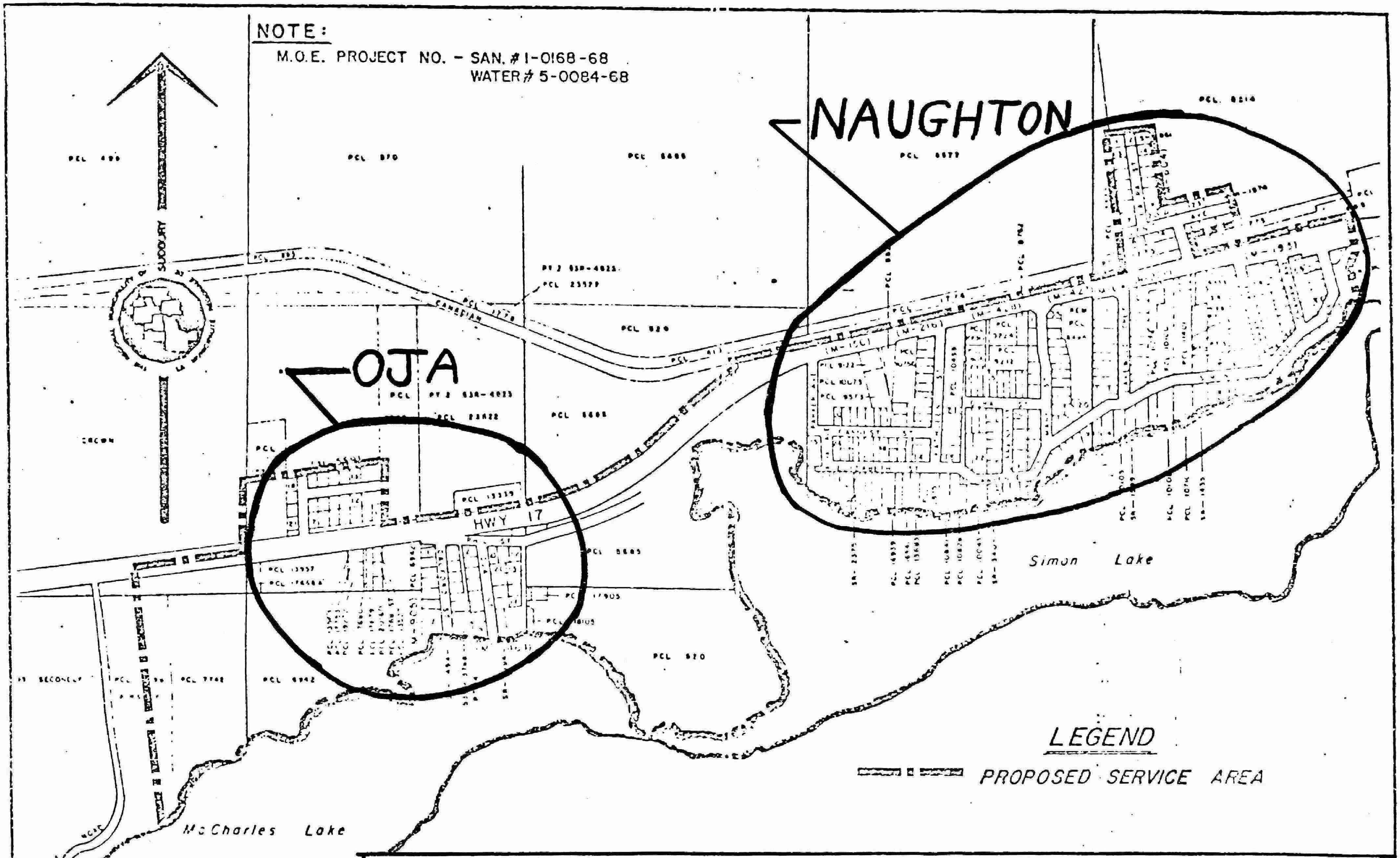
From the findings of this survey it is obvious that the environmental and health problems are different for each of the areas. In some locations it would be possible to solve the problems by relocating a well, upgrading the sewage system, etc. This would be possible in the more rural areas with large lots. However, in the larger urbanized areas such as Mikkola and Naughton it would be difficult if not impossible to correct the existing problems. On the basis of the environmetal and potential health problems, and taking into consideration the possibility of correcting some of the problems in the less urbanized areas, it is possible to rate the need for communal water and sewer services in the individual areas of the study as follows:

1. Naughton
2. Old Soo Road, Black Lake Road, Pentney
3. Mikkola
4. Mountainview, Rauhala
5. Oja

## RECOMMENDATIONS

A communal water system should be installed in the area studied in order to reduce the potential health problems.

The installation of a communal water system should be given priority over sewage collection and treatment works at this time.

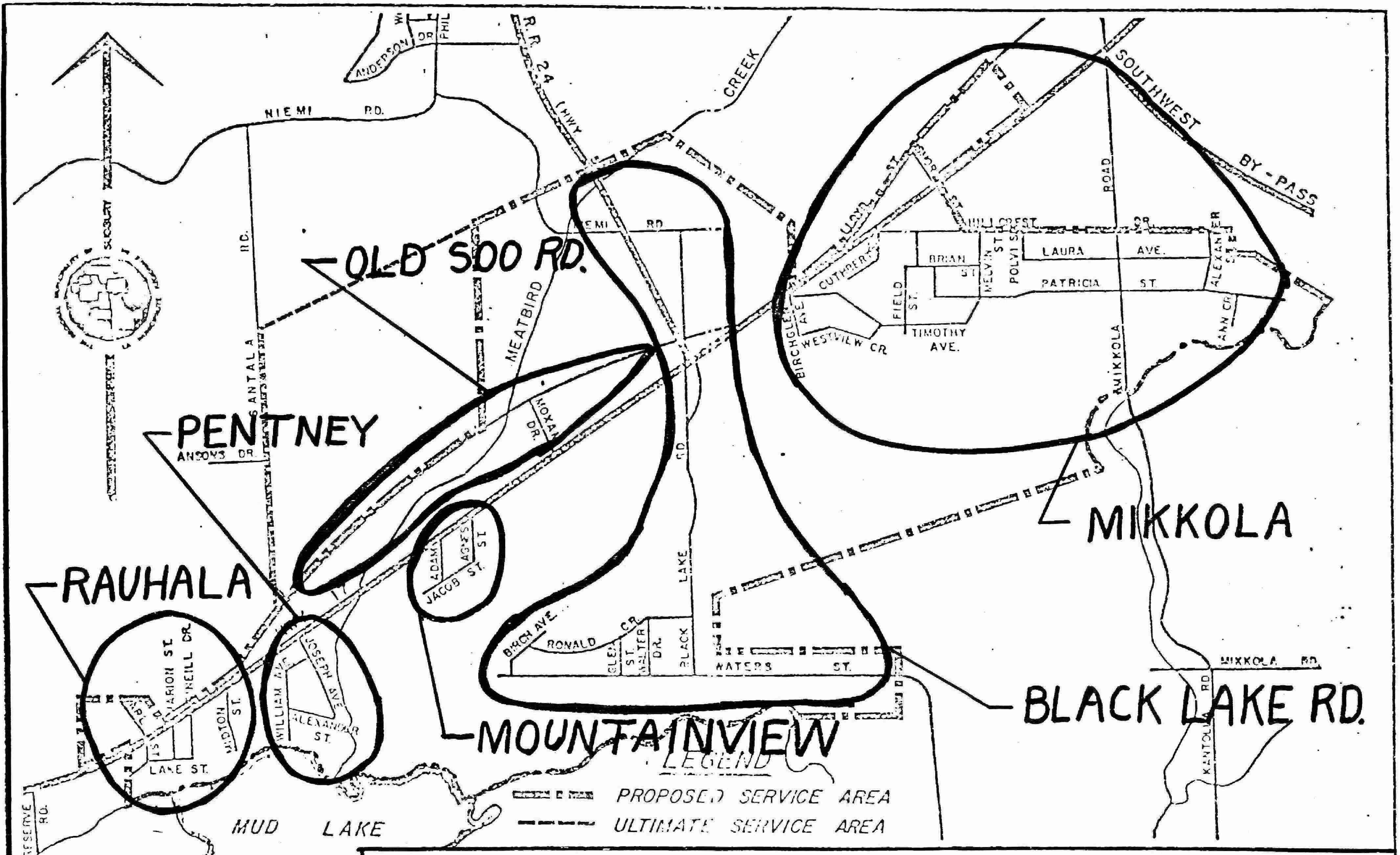


WATER QUANTITY AND QUALITY SURVEY,
(Naughton - Waters)
TOWN OF WALDEN

JANUARY 1977

MAP 1

APPENDIX A



NOTE:
M.O.E. PROJECT NO.
SAN. # 1-0201-69
WATER # 5-0102-69

WATER QUANTITY AND QUALITY SURVEY
(Naughton - Waters)
TOWN OF WALDEN

JANUARY 1977

MAP 2
APPENDIX A

PRINT ALL INFORMATION

SURVEY FORM

QUESTIONNAIRE

APPENDIX B

COMMUNITY: ___ ___ ______________________

INFORMATION RECEIVED FROM: ______________

SURVEYED BY: ______________________

## SAMPLE INFORMATION

| | | | | | |
|---|---|---|---|---|---|
| Type | Bacteriological | | Chemical | | |
| Sample No. | | | | | |
| Sample Location | | | | | |
| Results | Total | Faecal | Total | Faecal | |
| | | | | | |

## PROPERTY INFORMATION

Name of Owner ______________________ Owner's Phone No. __________

Permanent Address ______________________

Name of Resident ______________________

| Lot No. | Conc.No. | Township | Community | Street Address | Phone No. |
|---|---|---|---|---|---|
| | | | | | |

| Size of Lot | Drainage | Topography | Soil Type |
|---|---|---|---|
| | | | |

| No. of Residents | No. of Bedrooms | Laundry Facilities | Other |
|---|---|---|---|
| | | | |

## SEWAGE DISPOSAL SYSTEM

| Type | Septic Tank ______<br>Tile Bed ______<br>(enter distances) | Leaching Pit | Pit Privy | Other (Specify) |
|---|---|---|---|---|
| | | | | |

| Age | Distance to Surface Water | Distance to Water Supply | |
|---|---|---|---|
| | | | |

Comments: ______________________

| | |
|---|---|
| | Note Quantity |
| | |

## WATER SUPPLY

| Type | Surface Water | Dug Well | Drilled Well | Cased Well | Point |
|---|---|---|---|---|---|
| | | | | | |

| Depth | Age | Type & Capacity of Pressure System | Type of Pipe | Chlorinator | Filtration |
|---|---|---|---|---|---|
| | | | | | |

| Comments: | Taste | Odour | Colour | Iron | Hardness | Quantity | Quality | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

DIAGRAM ON REVERSE SIDE SHOWING LOCATION AND DISTANCES FOR WATER SUPPLY AND SEWAGE DISPOSA

TABLE 1

APPENDIX C

# WATER QUANTITY AND QUALITY SURVEY

## (Naughton - Waters)

## TOWN OF WALDEN

## QUESTIONNAIRE RESULTS

| AREA | No. of Samples | Type of Well | | | | | | Water Supply | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Dug | | Point | | Drilled | | Sufficient | | Insufficient | |
| | | No. | % | No. | % | No. | % | No. | % | No. | % |
| OJA | 13 | 5 | 38 | 4 | 31 | 4 | 31 | 10 | 77 | 3 | 23 |
| NAUGHTON | 79 | 49 | 62 | 25 | 32 | 5 | 6 | 49 | 62 | 30 | 38 |
| RAUHALA | 24 | 15 | 63 | 8 | 33 | 1 | 4 | 18 | 75 | 6 | 25 |
| OLD SOO RD. | 13 | 5 | 38 | 7 | 54 | 1 | 8 | 10 | 77 | 3 | 23 |
| PENTNEY | 15 | 13 | 87 | 0 | 0 | 2 | 13 | 14 | 93 | 1 | 7 |
| MOUNTAINVIEW | 9 | 8 | 89 | 0 | 0 | 1 | 11 | 7 | 78 | 2 | 22 |
| * BLACK LAKE RD. | 30 | 10 | 33 | 13 | 43 | 5 | 17 | 25 | 83 | 5 | 17 |
| * MIKKOLA | 66 | 21 | 32 | 17 | 26 | 26 | 39 | 42 | 64 | 24 | 36 |
| * TOTAL | | 126 | 56 | 74 | 30 | 45 | 18 | 175 | 70 | 74 | 30 |

* ADDITIONAL SOURCES

2 Spring sources in Black Lake Road (7%)

2 Cisterns in Mikkola (3%)

TABLE 2

APPENDIX C

# WATER QUANTITY AND QUALITY SURVEY

## (Naughton - Waters)

## TOWN OF WALDEN

## REPORT ON BACTERIOLOGICAL, CHEMICAL AND PHYSICAL QUALITY OF WATER SUPPLIES

| AREA | No. of Samples | Bacteriologically Contaminated | | Excessive* Nitrate | | Excessive* Iron | | Excessive* Colour | | Excessive* Turbidity | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | No. | % | No. | % | No. | % |
| OJA | 13 | 2 | 15 | 0 | 0 | 7 | 54 | 6 | 46 | 6 | 46 |
| NAUGHTON | 79 | 18 | 23 | 10 | 13 | 17 | 22 | 26 | 33 | 30 | 38 |
| RAUHALA | 24 | 4 | 17 | 2 | 8 | 10 | 42 | 4 | 19 | 9 | 43 |
| OLD SOO RD. | 13 | 6 | 46 | 0 | 0 | 4 | 31 | 5 | 38 | 7 | 54 |
| PENTNEY | 15 | 3 | 20 | 5 | 33 | 4 | 27 | 6 | 40 | 7 | 47 |
| MOUNTAINVIEW | 10 | 3 | 33 | 0 | 0 | 3 | 33 | 5 | 50 | 6 | 60 |
| BLACK LAKE RD. | 31 | 15 | 48 | 0 | 0 | 8 | 27 | 13 | 43 | 17 | 57 |
| MIKKOLA | 67 | 2 | 3 | 4 | 6 | 15 | 22 | 23 | 34 | 30 | 45 |
| TOTAL | | 53 | 21 | 21 | 8.4 | 68 | 27 | 88 | 35 | 112 | 45 |

* Excessive for nitrate indicates greater than 10 mg/l
Excessive for iron indicates greater than 0.3 mg/l
Excessive for colour indicates greater than 5 Hazen units
Excessive for turbidity indicates greater than 1 Formazin Turbidity unit.

TABLE 3

APPENDIX C

## WATER QUANTITY AND QUALITY SURVEY

## (Naughton - Waters)

## TOWN OF WALDEN

## RANGES AND MEANS FOR NITRATES AND IRON VALUES

| AREA | NITRATES - mg/l | | IRON - mg/l | |
|---|---|---|---|---|
| | Range | Mean | Range | Mean |
| OJA | <.1 - 8.4 | 1.4 | .05 - 2.0 | 0.67 |
| NAUGHTON | <.1 - 32.0 | 3.4 | < .05 - 2.4 | 0.25 |
| RAUHALA | <.1 - 28.0 | 2.7 | < .05 - 3.2 | 0.33 |
| OLD SOO ROAD | <.1 - 2.7 | 1.2 | < .01 - 2.2 | 0.40 |
| BLACK LAKE ROAD | <.1 - 4.6 | 0.69 | 0.10 - 4.5 | 0.51 |
| PENTNEY | <.1 - 21.0 | 6.9 | < .05 - 4.9 | 0.49 |
| MOUNTAINVIEW | 0.1 - 7.1 | 1.9 | < .05 - .45 | 0.25 |
| MIKKOLA | <.1 - 20.0 | 2.4 | < .01 - 1.14 | 0.20 |

TABLE 4

APPENDIX C

## WATER QUANTITY AND QUALITY SURVEY

## (Naughton - Waters)

## TOWN OF WALDEN

### SURFACE WATER BACTERIOLOGICAL EXAMINATION

| AREA | SAMPLE LOCATION | COLIFORM/ 100 ML Total | Fecal |
|---|---|---|---|
| OJA | Creek Draining Cri-Lor Trailer Park at Highway 17 | 11,300 | 1,200 |
| NAUGHTON | Creek at Earnest St. | 1,400 | 90 |
|  | Creek at South End of Simon Lake Drive | 700 | 50 |
| OLD SOO ROAD | Ditch by Moxam Drive (average of duplicate sample) | 54,000 | 1,800 |
|  | Ditch on Moxam Drive | 2,400,000 | 180,000 |
| BLACK LAKE ROAD | Small Creek on Black Lk.Rd. | 135 | 30 |
|  | Small Creek on Black Lk.Rd. | 49,000 | 3,300 |
|  | Small Creek on Ronald Cres. | 6,500 | 900 |
|  | Ditch - Cemetery Road | 190 | 0 |
| MOUNTAINVIEW | Creek by 10 Joseph Street | 15 | 0 |
|  | Ditch at Agnes Street | 250 | 0 |

# GLOSSARY

## (i) BACTERIOLOGICAL EXAMINATION

### Total Coliform Organisms

Total coliform organisms include a wide variety of bacteria ranging from the genus (Group), Escherichia Coli, which originate mainly in the intestines of man and other warm-blooded animals, to the genera Citrobacter and Enterobacter aerogenes. The latter genera are basically found in soil but are also present in faeces in small numbers.

The presence of total coliforms in water may indicate soil runoff or more important, less recent faecal pollution since organisms of the Enterobacter - Citrobacter groups tend to survive longer in water than do members of the Escherichia Coli group, and even multiply when suitable environmental conditions exist.

### Faecal Coliform Organisms

The faecal coliform organisms are those coliform bacteria which are all intestinal in origin and usually outnumber all other coliform types in human and animal intestines. Most of the coliform bacteria found by the faecal coliform test are of the genus Escherichia Coli. However, their death rate outside the warm body is high and accordingly if coliforms present in the water are primarily faecal coliforms, and their number is high, the pollution is probably nearby and recent. Smaller numbers with a high portion of faecal coliforms may indicate nearby pollution with counts reduced by dilution.

Results are reported "coliform count per 100 millilitres".

## (ii) CHEMICAL ANALYSIS

### Hardness

The total hardness measures the "soap consuming power" of a water due to the presence of metallic cations. The principle components of hardness are calcium and magnesium although a number of heavy metals may contribute to a small extent. The hardest waters are usually encountered in regions with thick top soil layers and extensive limestone deposits.

Hard waters are objectionable because they form insoluble compounds or curds with soap. This substantially reduces the efficiency of washing procedures even when detergents are used. Waters with high hardness are know to cause the formation of a lime scale in plumbing fixtures.

### Alkalinity

The alkalinity of the water is generally used to define the buffering capacity or the waters capability to resist a change in pH. This means that if an acidic waste is discharged to a natural water system the effect on the water may not necessarily be detected as a pH change but will be detected as a drop in alkalinity.

### Iron

Iron is the most abundant of the heavy metals in nature, but despite this abundance, it is generally found in relatively low levels in natural surface waters. Iron is non-toxic even at high levels but becomes objectionable in water because of the colour and bitter taste it imparts. The water quality objective for Ontario drinking water is 0.3 mg/l as iron.

### Chloride

Chloride is a major anion in domestic wastes and in many natural water supplies. Urban runoff often contains high concentrations of chloride in the winter time due to road application of salt.

Chloride poses no direct health hazard, but the water quality objective for domestic water supplies has been specified at 250 mg/l to prevent a salty taste. This salty taste is variable and dependent on the composition of the water. If chloride is present as sodium chloride a dectectable taste will be present at 250 mg/l. If chloride is present as calcium or magnesium chlorides, waters containing as much as 1,000 mg/l may not have a noticeable taste.

## pH

The Hydrogen Ion concentraction in water is measured as pH. Specifically, it is the negative logarithm of the hydrogen ion concentration expressed in moles per litre. Thus, each change of one unit in pH corresponds to a 10 fold change in the hydrogen ion concentration.

## Apparent Colour Units

Many lakes and rivers, especially in Northern Ontario, have a characteristic yellowish-brown colour due to the presence of humic acids derived from the decomposition of plants. Lakes of this type are commonly referred to as "acid bog" or "brown water" lakes. A similar colour may also occur when iron and maganese are found in abundance.

Water coloured naturally by humic substances is harmless, but considered unacceptable for drinking purposes because of its appearance. The objective of 5 colour units for domestic water supplies is therefore based on aesthetic rather than on health standards.

## Turbidity

The turbidity is a measure of the opticle properties of a sample which causes light to be scattered and adsorbed rather than transmitted in a straight line. Historically, the turbidity was measured using a Jackson candle turbidmeter, but the insensitivity of this instrument lead to the development of secondary techniques which can measure the much lower turbidities commonly encountered in modern water treatment processes.

## Specific Conductance

The specific conductance is a measure of a waters capacity to carry an electric current. This property is related to the total concentration of ionized substances in the water. The conductivity of natural waters is mainly due to the presence of calcium, magnesium, sodium, pottassium, bicarbonate, chloride, sulphate and nitrate ions.

Specific conductance related quite well to the total dissolved solids concentration. Ontario rivers and lakes free of industrial wastes, have a total dissolved solids concentration generally equal to 0.65 ± 0.10 x the specific conductance.

## Nitrate (Nitrogen)

Nitrates are formed via the oxidation of nitrite by autotrophic nitrifying bacteria and represents the most highly oxidized form of nitrogen in the nitrogen cycle. It is generally found at trace levels in all surface waters but may become very high in ground waters as a result of soil leaching.

Nitrates are objectionable because their nutritive properties promote the excessive growth of algae and other aquatic plants. Excessive amounts in drinking water contribute to a disease known as infant methemoglobinemia in which the oxygen carrying capacity of the blood is inhibited. The maximum acceptable level for domestic water supplies in Ontario is 10 mg/l of nitrate as nitrogen in the water if it is to be used for infant feeding. Nitrates are non-toxic to adults.

*96936000009490*